

COVER SYSTEM AND STARTER FERTILIZER  
PLACEMENT FOR NO-TILL COTTON  
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### Abstract

A field study comparing cotton growth and yields in two no-tillage systems with conventionally tilled cotton was conducted in 1991 and 1992. The study was located in north Alabama on a Decatur silt loam soil (Rhodic Paleudult).

The two no-tillage cover systems evaluated were: 1) old cotton stubble or, 2) fall seeded wheat, killed two weeks prior to planting. Starter fertilizer treatments consisted of liquid fertilizers supplying N and  $P_2O_5$  rates of 0-0, 15-0, and 15-50 lb.  $A^{-1}$ , applied either in a band 4 inches over the row or 2x2 placed.

Cotton yields averaged only about 1 bale per acre in 1991 due to drought, but averaged over 2 bales per acre due to abundant rainfall in 1992. Both years cotton planted in the old cotton stubble produced a much more compact plant than cotton conventionally tilled or no-tilled into wheat. Part of this growth reduction may be explained by soil penetrometer readings indicating the soil in the old stubble was much more compacted, especially in the upper 12 inches, than either conventional tillage or no-tilled into wheat. Soil penetrometer reading below 12 inches also indicated that the wheat cover was reducing soil compaction at these lower soil depths. Why this is occurring is unclear.

Although no-till cotton into old stubble showed visual growth differences compared to no-till into wheat and conventional tillage, only in 1991 was a yield difference found between tillage systems. This was due to increased yields with starter fertilizers in the no-till systems while conventional tilled cotton did not respond to starter fertilizer. No-till cotton yields in wheat were increased by all starter treatments, however, only starter fertilizer place 2x2 increase cotton yields, compared to no starter, in old cotton stubble. In 1992 only 15-50 starter fertilizer banded with conventional tillage increased cotton yields compared to no starter.

Results indicate similar cotton yields with cotton no-tilled into wheat or old stubble compared to conventional tillage. Possible response to starter fertilizer was greater under no-till than conventional tillage. Erratic cotton response to starter placement, however, produced no clear conclusion whether banding starter fertilizer over the seed furrow would equal response to starter fertilizer 2x2 placed.

### Introduction

Northern Alabama, an area of intense cotton production, has many soil types which are considered highly erodible and therefore must have approved soil conservation plans to meet requirements of the 1985 farm bill. One of the methods farmers can use to meet soil erosion tolerances is to switch to a no-till or minimum till cotton system.

The two no-till cover systems used by most north Alabama cotton farmers are: 1) planting into old cotton residue or, 2) planting into a wheat cover killed at least two weeks prior to planting.

Many growers prefer the old stubble cover because of easier cotton stand establishment and the time and costs involved in planting wheat in the fall. However, Alabama research by Brown et al. (1) in the early 1980's and more recent trials by Burmester (unpublished data) indicate possible growth problems with cotton planted into old cotton stubble. Reduced

cotton stalk size and reduced cotton yields have often been found when cotton is planted into old stubble compared to a small grain cover or conventionally tilled cotton. The reasons for these reductions are unexplained.

The beneficial effects of using starter fertilizers placed 2x2 in no-till cotton has also been demonstrated in Alabama field studies by Touchton et al. (3). However, due to the additional application equipment needed for 2x2 placement, few Alabama growers use starter fertilizers on their no-till cotton. Placement of starter fertilizer in a 4-inch band over the cotton seed furrow at planting has produced similar yield increases as 2x2 placement in Mississippi studies by Funderburg (2). If similar results are found on no-till cotton in Alabama, growers could adapt their planters much easier to this surface placement of starter fertilizer.

The objectives of this study were 1) to determine cotton growth and yield limiting factors with the two most commonly used no-till cotton covers systems presently used in Alabama, and 2) compare surface band with 2x2 placement of starter fertilizers on cotton growth and yield in two no-till systems and conventionally tilled cotton.

### Materials and Methods

A field study was initiated in 1991 to further evaluate cotton response to no-till production systems in northern Alabama. The test was conducted on a Decatur silt loam (Rhodic Paleudult) with a soil test rating of "High" for both phosphorus (P) and potassium (K). Tillage treatments included: 1) no-till into old cotton stubble, 2) no-till into wheat killed two weeks prior to planting, and 3) a conventionally tilled system. Liquid fertilizers, 11-0-0 and 11-37-0 were applied to supply N and  $P_2O_5$  starter fertilizer rates of 0-0, 15-0 and 15-50 lb.  $A^{-1}$ . Starter fertilizers were placed in a 4-inch band over the seed furrow or place 2x2 at planting in all tillage treatments. The cotton variety used both years was Detapine 50. All treatments received 60 lb.  $A^{-1}$  of fertilizer N preplant and 30 lb.  $A^{-1}$  of fertilizer N sidedressed in mid June.

Cotton stand counts were used to measure stand establishment problem and cotton height measurements were taken at early stand establishment and at early bloom each year. In 1992, six plants from each plot were harvested, dried and weighed for dry matter accumulation in mid June.

In 1992 soil penetrometer reading were made two weeks after cotton emergence and in mid-August in the no starter plots of each cover system. Five penetrations were made in nontrafficked row middles.

Measurements were made using a hand held Bush recording soil penetrometer (Mark I Model 1979; Findlay, Irvine Ltd., Penicuik, Scotland).

In 1991 and 1992 cotton yields were determined by mechanically picking the two center rows from each plot.

### Results and Discussion

Rainfall and DD60 accumulation differed greatly between the 1991 and 1992 growing season (Table 1.) In 1991, drought and high DD60 accumulation in June and July resulted in low cotton yields. In 1992 abundant rainfall but low DD60's resulted in a delayed crop but excellent yields. Similar planting dates were used each year, but first harvest was on September 16th in 1991 and October 23rd in 1992.

Early season stand counts both years indicated that starter fertilizers had no effect on cotton stand (Table 2). Tillage treatments had no effect on final cotton stand counts in 1991, but in 1992 conventionally tilled cotton had a slightly higher plant population than either no-till systems (Table 2). This was due to more soil crusting in the no-till systems after planting. These no-till systems held more soil moisture at planting and were more prone to form a hard crust than drier conventionally planted cotton.

Cotton height measurements taken after stand establishment and at early bloom showed similar results both years (Table 3). Early season height differences showed no consistent response to starter fertilizer in any tillage treatment both years. At early bloom, however, cotton grown no-till into stubble was consistently shorter than cotton planted in conventional tillage, or cotton planted no-till into wheat (Table 3). In 1992, early season height of no-till cotton planted into wheat, was about one inch taller than conventional or no-till cotton planted into stubble regardless of any starter fertilizer. The only consistent height difference caused by the starter fertilizer was in the cotton no-till in wheat. In both years the starter fertilizer 15-50 placed 2x2 or banded and starter fertilizer 15-0 placed 2x2 increased cotton height compared to the no starter treatment (Table 3).

In 1992 cotton dry matter accumulation results in mid June paralleled the height measurements. In the wheat cover all starter fertilizers, except 15-0 banded, increased cotton dry matter accumulation compared to the no starter treatment (Table 3).

In 1992, soil penetrometer measurements two weeks after planting (Fig. 1) indicated the no-till stubble and wheat covers had much higher resistance to penetration than conventionally tilled cotton down to about 12 inches. Below 12 inches, resistance in the no-till stubble and conventional tillage were similar, but resistance in the no-till wheat was consistently 2 to 6 bars less down to 20 inches.

The August 1992 soil penetrometer measurements could only be consistently taken down to 12 inches due to low moisture at greater depths (Fig. 2). The no-till stubble again had much higher soil resistance to penetration at all depths compared to no-till wheat and conventional tilled cotton. The no-till into wheat had greater soil resistance to penetration from 0 to 8 inches than conventional tilled cotton. However, at 10 and 12 inch depths no-till wheat soil resistance averaged 11 and 16 bars less respectively compared to conventional tilled cotton.

Cotton yields (Table 4) averaged about 1 bale in 1991 and 2.3 bales in 1992. Only in 1991 was there a yield difference found between tillage systems. This was due to increased yields with starter fertilizers in the no-till systems while the conventionally tilled cotton did not respond to starter fertilizers. In 1991 no-till cotton yields in wheat were increased by all starter fertilizers and regardless of placement compared to the no starter treatment. The no-till cotton into old stubble, however, only increased cotton yields, compared to no starter, when the starter fertilizer was placed 2x2. In 1992 no consistent responses to tillage or starter fertilizer were found, although the 15-50 starter fertilizer banded increased cotton yields in the conventionally tilled cotton.

Results of this study indicate that there are some growth differences between cotton planted no-till into wheat or old cotton stubble compared to conventional tilled cotton. The cotton planted no-till into cotton stubble produced a much more compact plant than cotton no-till into wheat or planted in conventionally tilled soil. Part of this may be explained by the soil penetrometer reading indicating the soil in the old stubble was much more compacted, possibly limiting root growth or water infiltration. Soil penetrometer reading also indicated that at depths below 10 to 12 inches the wheat cover was reducing soil compaction compared to conventional

tillage or no-till into stubble. The reasons for this are unclear. Although no-till cotton into wheat and old stubble produced some cotton growth differences, cotton yields were similar to conventionally tilled cotton each year.

Starter fertilizer had little effect on early season cotton growth each year. Increases in growth caused by starter fertilizers, however, were measured at early bloom especially in the cotton no-till into wheat. Cotton yield response to starter fertilizer and placement was erratic between years. However, these results support previous findings that response to starter fertilizers is more likely with cotton no-till than with conventionally tilled cotton.

### Literature Cited

1. Brown, S.M., T. Whitwell, J.T. Touchton and C.H. Burmester. 1985. Conservation tillage systems for cotton production. Soil Sci. Soc. Am. J. 49:1256-1280.
2. Funderburg, E.R. 1988. Effect of starter fertilizers on cotton yields in Mississippi. Proc. Beltwide Cotton Production Research Conferences. pp. 496-498.
3. Touchton, J.T., J.H. Rickerl, C.H. Burmester and D.W. Reeves. 1986. Starter fertilizer combinations and placement for conventional and no-tillage cotton. Journal of Fertilizer Issues. pp. 91-98.

Table 1. Rainfall and DD60 accumulation by months for 1991 and 1992 growing season.

Month	Rainfall (in.)		DD60	
	1991	1992	1991	1992
May	6.07	2.19	450	218
June	1.57	8.34	527	389
July	1.98	5.64	607	569
August	3.69	3.80	597	421
September	3.41	4.52	407	328
Total	22.7	26.1	2588	1925

Table 2. Average cotton stand counts in 1991 and 1992.

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Fertilizer		Conventional		Stubble		Wheat	
lb/A	Placement	91	92	91	92	91	92
-----plants / 6 feet-----							
0-0-0	-	23	33	23	29	27	29
15-0-0	Band	28	32	30	27	19	22
15-0-0	2x2	24	30	23	26	23	26
15-50-0	Band	22	33	19	31	24	25
15-50-0	2x2	23	33	24	25	21	27
LSD (0.05)		NS	7	NS	7	NS	7

Table 3. Effects of tillage systems and starter fertilizers on cotton height in 1991 and 1992 and dry matter in 1992.

matter in 1992.			Heights		Heights		Dry Matter
Starter Fertilizer			1991		1992		1992
lb/A	Place- ment	Tillage	June	July	June	July	June
			4	2	1	16	15
-----inches-----							g/6 plants
0-0	-	Conv.	8.0	24.0	3.8	31.3	27.0
15-0	Band	Conv.	8.0	25.3	4.3	32.0	25.0
15-0	2x2	Conv.	8.0	26.0	3.9	32.3	26.3
15-50	Band	Conv.	8.0	27.0	4.1	31.3	26.0
15-50	2x2	Conv.	9.0	24.3	4.3	32.3	29.7
0-0	-	Stubble	7.7	21.3	4.2	30.0	25.3
15-0	Band	Stubble	8.0	21.0	4.2	28.3	26.0
15-0	2x2	Stubble	7.3	21.7	4.0	30.3	26.0
15-50	Band	Stubble	8.0	21.3	4.3	30.3	27.0
15-50	2x2	Stubble	8.0	22.0	4.3	31.0	28.3
0-0	-	Wheat	9.0	23.0	5.2	31.0	29.6
15-0	Band	Wheat	9.0	24.0	4.9	31.0	28.3
15-0	2x2	Wheat	8.0	26.0	5.2	34.3	34.3
15-50	Band	Wheat	8.0	27.0	5.3	33.0	34.0
15-50	2x2	Wheat	9.0	26.0	5.3	35.6	34.3
LSD(0.05)			0.8	2.2	0.3	3.1	3.9

Table 4. Effect of tillage systems and starter fertilizers on seed cotton yields.

Starter fertilizer			Seed cotton yield		
N	P <sub>2</sub> O <sub>5</sub>	Placement	Tillage	1991	1992
				-----lb/A-----	
0-0	-		Conv.	1436	3307
15-0	Band		Conv.	1550	3376
15-0	2x2		Conv.	1450	3550
15-50	Band		Conv.	1410	3717
15-50	2x2		Conv.	1583	3318
0-0	-		Stubble	1353	3129
15-0	Band		Stubble	1463	3314
15-0	2x2		Stubble	1647	3267
15-50	Band		Stubble	1526	3314
15-50	2x2		Stubble	1647	3387
0-0	-		Wheat	1450	3176
15-0	Band		Wheat	1670	2842
15-0	2x2		Wheat	1670	3187
15-50	Band		Wheat	1620	3398
15-50	2x2		Wheat	1773	3423
LSD(0.10)				165	375

Depth (In.)

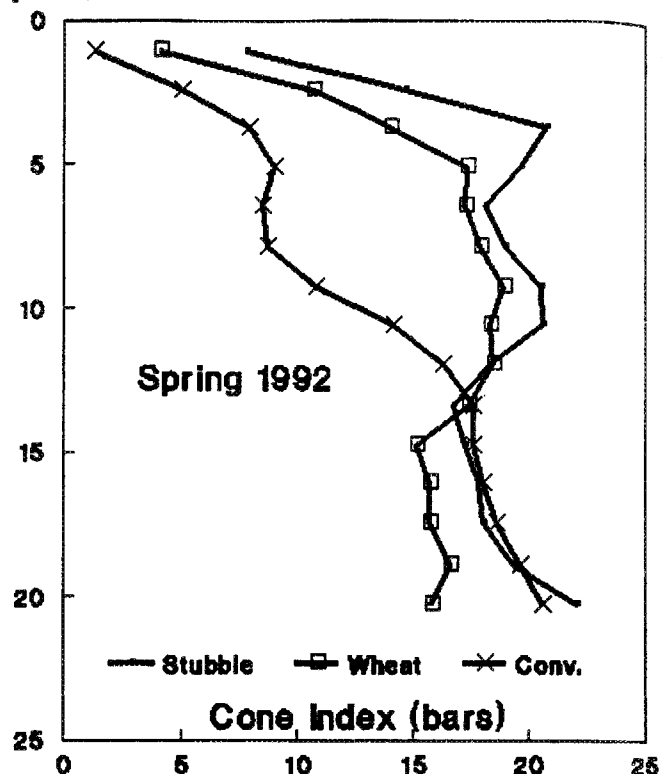


Figure 1. Penetrometer readings in spring 1992 for no starter treatment in each tillage system.

Depth (In.)

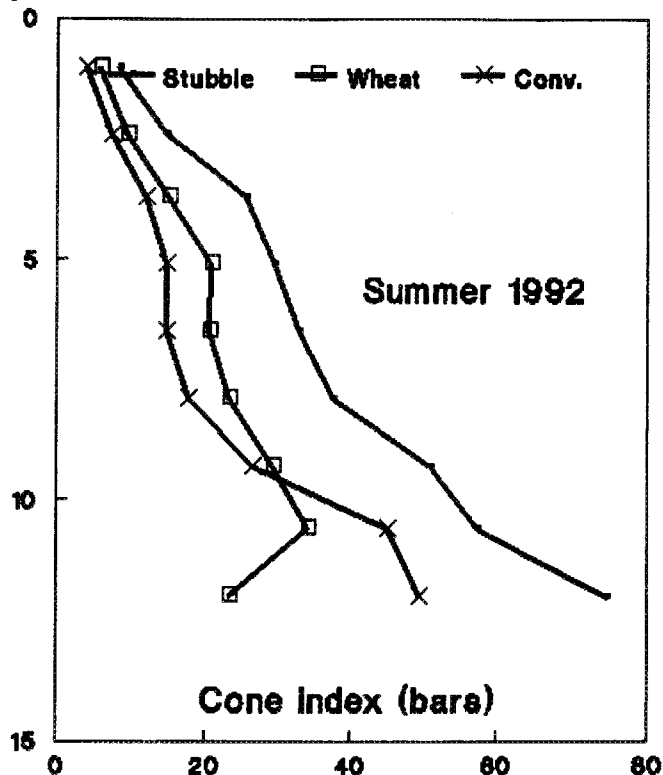


Figure 2. Penetrometer readings in summer 1992 for no starter treatment in each tillage system.

